CLAIMS

1) A Fabry-Perot optical fiber interference sensor having a sensor part having opposed surfaces formed as parallel planes to each other in a measured clearance varied in response to physical quantities such as force, strain, pressure and temperature and the like, having a partial reflection mirror or an end surface of one optical fiber formed with a partial reflection mirror arranged in one surface side of said opposed surfaces, and having an end surface of the other optical fiber formed with a partial reflection mirror arranged in the other surface side of said opposed surfaces, in which a light of low coherence light source is guided to said the other optical fiber, either a reflected light or a transmission light modulated in wavelength in correspondence with a clearance size of said measured clearance through multiple reflection at said measured clearance is guided by the optical fiber, optical intensities in time-series corresponding to a clearance variation are attained by an optical intensity distribution sensor, either a minimum optical intensity position or a maximum optical intensity position is detected to attain said measured clearance and a value of said physical quantity is measured, wherein the same is comprised of;

a wide range light source having a wide wavelength

spectrum distribution acting as said low coherence light source;

an optical correlation signal extracting means for extracting a desired optical correlation signal from the output signal in time-series of said optical intensity distribution sensor; and

an extreme value position calculating means for attaining either a minimum position or a maximum position at said optical correlation signal in reference to the optical correlation signal outputted from said optical correlation signal extracting means.

2) A Fabry-Perot optical fiber interference sensor having a sensor part having opposed surfaces formed as parallel planes to each other in a measured clearance varied in response to physical quantities such as force, strain, pressure and temperature and the like, having a partial reflection mirror or an end surface of one optical fiber formed with a partial reflection mirror arranged in one surface side of said opposed surfaces, and having an end surface of the other optical fiber formed with a partial reflection mirror arranged in the other surface side of said opposed surfaces, in which a light of low coherence light source is guided to said the other optical fiber, either a reflected light or a transmission light modulated in wavelength correspondence with a clearance size of said

measured clearance through multiple reflection at said measured clearance is guided by the optical fiber, optical intensities in time-series corresponding to a clearance variation are attained by an optical intensity distribution sensor, either a minimum optical intensity position or a maximum optical intensity position is detected to attain said measured clearance and a value of said physical quantity is measured, wherein the same is comprised of;

a wide range light source having a wide wavelength spectrum distribution acting as said low coherence light source;

an optical correlation signal extracting means for extracting a desired optical correlation signal from the output signal in time-series of said optical intensity distribution sensor;

a high frequency component removing and processing means for removing a high frequency non-required component in the optical correlation signal outputted from said optical correlation signal extracting means; and

an extreme value position calculating means for attaining either a minimum position or a maximum position at said optical correlation signal in reference to the optical correlation signal having the high frequency non-required component removed which is outputted from said high frequency component removing and processing means.

3) An optical fiber interference sensor according to claim 1, wherein said wide range light source is one of a halogen lamp and a white light emitting diode.

4) An optical fiber interference sensor according to claim 1, wherein said optical correlation signal extracting mean includes a background signal removing means for removing a background signal varied in response to said measured clearance from an output of said optical intensity distribution sensor.

5) An optical fiber interference sensor according to claim 4, wherein said background signal removing means includes means for estimating a background signal by a least square multinomial fitting and removing the background signal varied in reference to said measured clearance from an output of said optical intensity distribution sensor.

6) An optical fiber interference sensor according to claim 4, wherein said background signal removing means includes means for removing a background signal varied in reference to said measured clearance from an output of said optical intensity distribution sensor while an actual measured practical data under a state not including an optical correlation signal in a desired measuring range is being applied as a background signal.

7) An optical fiber interference sensor according to claim 1, wherein said extreme value position calculating means includes;

a smoothing differential processing means for smoothing differential processing said optical correlation signal in response to a polynomial adaptation smoothing method; and

a zero-cross point calculating means for calculating a zero-cross point where an output of said smoothing differential processing means crosses with a level zero.

8) An optical fiber interference sensor according to claim 2, wherein said high frequency component removing and processing means includes a low-pass filter.

9) A signal processing system of a Fabry-Perot optical fiber interference sensor having a sensor part having opposed surfaces formed as parallel planes to each other in a measured clearance, having a partial reflection mirror or an end surface of one optical fiber formed with a partial reflection mirror arranged in one surface side of said opposed surfaces, and having an end surface of the other optical fiber formed with a partial reflection mirror arranged in the other surface side of said opposed surfaces, in which a light of low coherence light source is guided to said the other optical fiber, either a reflected light or a

transmission light modulated in wavelength in correspondence with a clearance size of said measured clearance through multiple reflection at said measured clearance is guided by the optical fiber, optical intensities in time-series corresponding to a clearance variation are attained by an optical intensity distribution sensor, either a minimum optical intensity position or a maximum optical intensity position is attained to measure said measured clearance, wherein the same is comprised of;

a wide range light source having a wide wavelength spectrum distribution acting as said low coherence light source;

an optical correlation signal extracting means for extracting a desired optical correlation signal from the output signal in time-series of said optical intensity distribution sensor; and

an extreme value position calculating means for attaining either a minimum position or a maximum position at said optical correlation signal in reference to the optical correlation signal outputted from said optical correlation signal extracting means.

10) A signal processing system of a Fabry-Perot optical fiber interference sensor having a sensor part having opposed surfaces formed as parallel planes to each other in a measured clearance, having a partial reflection mirror or an

end surface of one optical fiber formed with a partial reflection mirror arranged in one surface side of said opposed surfaces, and having an end surface of the other optical fiber formed with a partial reflection mirror arranged in the other surface side of said opposed surfaces, in which a light of low coherence light source is guided to said the other optical fiber, either a reflected light or a transmssion light modulated in wavelength in correspondence with a clearance size of said measured clearance through multiple reflection at said measured clearance is guided by the optical fiber, optical intensities in time-series corresponding to a clearance variation are attained by an optical intensity distribution sensor, either a minimum optical intensity position or a maximum optical intensity position is attained to measure said measured clearance, wherein the same is comprised of;

a wide range light source having a wide wavelength spectrum distribution acting as said low coherence light source;

an optical correlation signal extracting means for extracting a desired optical correlation signal from the output signal in time-series of said optical intensity distribution sensor;

a high frequency component removing and processing means for removing a high frequency non-required component in the optical correlation signal outputted from said optical

correlation signal extracting means; and

an extreme value position calculating means for attaining either a minimum position or a maximum position at said optical correlation signal in reference to the optical correlation signal outputted from said optical correlation signal extracting means and having high frequency non-required component removed.

11) A recording medium capable of being read by a computer having a program for acting the computer as;

an optical correlation signal extracting means for extracting a desired optical correlation signal from an output signal in time-series of an optical intensity distribution sensor; and

an extreme position calculating means for attaining either a minimum position or a maximum position in said optical correlation signal from the optical correlation signal outputted from said optical correlation signal extracting means;

when a signal processing is carried out at a Fabry-Perot optical fiber interference sensor having a sensor part having opposed surfaces formed as parallel planes to each other in a measured clearance, having a partial reflection mirror or an end surface of one optical fiber formed with a partial reflection mirror arranged in one surface side of said opposed surfaces, and having an end surface of the other

optical fiber formed with a partial reflection mirror arranged in the other surface side of said opposed surfaces, in which a light of low coherence light source having a wide range of wavelength spectrum distribution is guided to said the other optical fiber, either a reflected light or a transmission light modulated in wavelength in correspondence with a clearance size of said measured clearance through multiple reflection at said measured clearance is guided by the optical fiber, optical intensities in time-series corresponding to a clearance variation are attained by said optical intensity distribution sensor, either a minimum optical intensity position or a maximum optical intensity position is attained to measure said measured clearance.

12) A recording medium capable of being read by a computer having a program for acting the computer as;

an optical correlation signal extracting means for extracting a desired optical correlation signal from an output signal in time-series of an optical intensity distribution sensor;

a high frequency component removing and processing means for removing a high frequency non-required component in the optical correlation signal outputted from said optical correlation signal extracting means; and

an extreme position calculating means for attaining either a minimum position or a maximum position in said

optical correlation signal from the optical correlation signal outputted from said high frequency component removing and processing means and having a high frequency non-required component removed;

when a signal processing is carried out at a Fabry-Perot optical fiber interference sensor having a sensor part having opposed surfaces formed as parallel planes to each other in a measured clearance, having a partial reflection mirror or an end surface of one optical fiber formed with a partial reflection mirror arranged in one surface side of said opposed surfaces, and having an end surface of the other optical fiber formed with a partial reflection mirror arranged in the other surface side of said opposed surfaces, in which a light of low coherence light source having a wide range of wavelength spectrum distribution is guided to said the other optical fiber, either a reflected light or a transmission light modulated in wavelength in correspondence with a clearance size of said measured clearance through multiple reflection at said measured clearance is guided by the optical fiber, optical intensities in time-series corresponding to a clearance variation are attained by said optical intensity distribution sensor, either a minimum optical intensity position or a maximum optical intensity position is attained to measure said measured clearance.

13) A Fabry-Perot optical fiber interference sensor having a

sensor part having opposed surfaces formed as parallel planes to each other in a measured clearance varied in response to physical quantities such as force, strain, pressure and temperature and the like, having a partial reflection mirror or an end surface of one optical fiber formed with a partial reflection mirror arranged in one surface side of said opposed surfaces, and having an end surface of the other optical fiber formed with a partial reflection mirror arranged in the other surface side of said opposed surfaces, in which a light of low coherence light source is guided to said the other optical fiber, any one of a reflected light and a transmission light modulated in wavelength in correspondence with a clearance size of said measured clearance through multiple reflection at said measured clearance is guided by the optical fiber, the light is condensed linearly in a uniform optical intensity distribution, radiated onto a linear image sensor through a Fizeau interferometer, a maximum optical intensity position at said linear image sensor is detected from an output of said linear image sensor to attain said measured clearance and a value of said physical quantity is measured, wherein the same is comprised of;

an optical correlation signal extracting means for extracting a desired optical correlation signal from the output signal in time-series of said linear image sensor;

a non-required component removing and processing means

for removing a high frequency non-required component and a low frequency non-required component of the output of said optical correlation signal extracting means;

a phase shift processing means for shifting by 90° a phase of the output of said non-required component removing and processing means;

an envelope calculating means for attaining an envelope component of the output of said non-required component removing and processing means in reference to an output of said non-required component removing and processing means and an output of said phase shift processing means with its phase being shifted by 90°; and

a peak position calculating means for differentiating an output of said envelope calculating means and attaining a zero-cross point where said differentiated value may cross with a level zero.

14) An optical fiber interference sensor according to claim 13, wherein,

said non-required component removing and processing means includes;

a low-pass filter processing means for removing a high frequency noise component from an output of said optical correlation signal extracting means through the low-pass filter processing; and

a high-pass filter processing means for removing a low

frequency non-required component from an output of said low-pass filter processing meansoptical correlation signal extracting means through a high-pass filter processing.

15) An optical fiber interference sensor according to claim 13, wherein,

said non-required component removing and processing means is comprised of;

a low-pass filter processing means for removing a high frequency noise component from an output of said optical correlation signal extracting means by a low-pass filter processing; and

a least square processing means for removing a low frequency non-required component from an output of said low pass filter processing means by a least square fitting method.

16) An optical fiber interference sensor according to claim 13, wherein said phase shift processing means includes a phase shift processing means for shifting a phase of an output of said non-required component removing and processing means by 90° by performing a Hilbert transform.

17) An optical fiber interference sensor according to claim 13, wherein said envelope calculating means includes;

means for calculating a square root of square sum to

attain an envelope component of an output of said non-required component removing and processing means by calculating a square root of square sum of an output of said non-required component removing and processing means and an output of said phase shift processing means with its phase being shifted by 90°; and

a high frequency removing means for removing a high frequency non-required component of output of said means for calculating a square root of square sum by a low-pass filter processing.

18) An optical fiber interference sensor according to claim 13, wherein said peak position calculating means includes;

a smoothing and differentiating processing means for smoothing and differentiating processing an output of said envelope calculating means in reference to a multinomial adaptation smoothing method; and

a zero-cross point calculating means for attaining a zero cross-point where an output of said smoothing and differentiating processing means crosses with a level zero.

19) A signal processing system of a Fabry-Perot optical fiber interference sensor having a sensor part having opposed surfaces formed as parallel planes to each other in a measured clearance, having a partial reflection mirror or an

end surface of one optical fiber formed with a partial reflection mirror arranged in one surface side of said opposed surfaces, and having an end surface of the other optical fiber formed with a partial reflection mirror arranged in the other surface side of said opposed surfaces, in which a light of low coherence light source is guided to said the other optical fiber, any one of a reflected light and a transmission light modulated in wavelength in correspondence with a clearance size of said measured clearance through multiple reflection at said measured clearance is guided by the optical fiber, the light is condensed in a linear manner under a uniform optical intensity distribution, radiated onto a linear image sensor through a Fizeau interferometer, the maximum optical intensity position at said linear image sensor is attained in reference to an output of said linear image sensor to measure said measured clearance, wherein the same is comprised of;

an optical correlation signal extracting means for extracting a desired optical correlation signal from the output signal in time-series of said linear image sensor;

a non-required component removing and processing means for removing a high frequency non-required component and a low frequency non-required component of an output of said optical correlation signal extracting means;

a phase shift processing means for shifting by 90° a phase of an output of said non-required component removing

and processing means;

an envelope calculating means for attaining an envelope component of output of said non-required component removing and processing means in reference to an output of said non-required component removing and processing means and an output of said phase shift processing means with its phase being shifted by 90°; and

a peak position calculating means for differentiating an output of said envelope calculating means to attain a zero-cross point where said differentiated value crosses with a level zero.

20) A recording medium capable of being read by a computer which has a program for acting the computer as;

an optical correlation signal extracting means for extracting a desired optical correlation signal from an output signal in time-series of a linear image sensor;

a non-required component removing and processing means for removing a high frequency non-required component and a low frequency non-required component of an output of said optical correlation signal extracting means;

a phase shift processing means for shifting by 90° a phase of an output of said non-required component removing and processing means;

an envelope calculating means for attaining an envelope component of the output of said non-required component

removing and processing means in reference to an output of said non-required component removing and processing means and an output of the phase shift processing means with its phase being shifted by 90°; and

a peak position calculating means for differentiating an output of said envelope calculating means to attain a zero-cross point where said differentiated value may cross with a level zero;

when a signal processing is carried out at a Fabry-Perot optical fiber interference sensor having a sensor part having opposed surfaces formed as parallel planes to each other in a measured clearance, having a partial reflection mirror or an end surface of one optical fiber formed with a partial reflection mirror arranged in one surface side of said opposed surfaces, and having an end surface of the other optical fiber formed with a partial reflection mirror arranged in the other surface side of said opposed surfaces, in which a light of low coherence light source is guided to said the other optical fiber, any one of a reflected light and a transmission light modulated in wavelength in correspondence with a clearance size of said measured clearance through multiple reflection at said measured clearance is guided by the optical fiber, the light is condensed linearly in a uniform optical intensity distribution, radiated onto said linear image sensor through a Fizeau interferometer, the maximum optical intensity

position in said linear image sensor is calculated in reference to an output of said linear image sensor so as to measure said measured clearance.